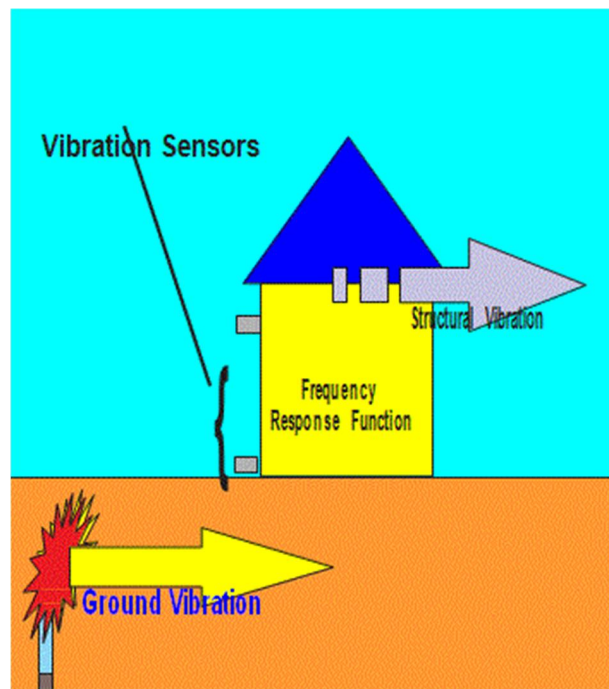


Blasting regulations enforced by the Mineral Mining Program of the Virginia Department of Energy establish safe blasting practices intended to protect miners, private property, and the public. The limits established for the off-site effects of ground vibration, air overpressure, and flyrock are based upon those recommended by the U.S. Bureau of Mines Report of Investigation RI 8507; this report establishes recommended limits for vibration and air overpressure necessary to prevent structure damage based on long-term studies and is considered the primary source for the regulation of blasting activities at mines.

Many of the mineral mines in Virginia that utilize blasting are located in close proximity to residential and commercial development. Mine operators and blasters are challenged with designing blasts that will produce enough rock for production demand, while at the same time minimizing the impact of ground vibration and air overpressure on nearby private property owners.



**Flyrock** presents the largest potential hazard

to persons of private property at or near the blast site. Although the number of flyrock incidents has decreased over the years, occasional incidents occur, and are investigated each year. Mineral Mining Program safety regulation 4VAC25-40-800.D requires certified blasters to design shots with sufficient burden and stemming to prevent flyrock or other dangerous effects. Investigations reveal that many of the incidents resulted from insufficient containment of fractured burden around loaded boreholes.

When blasting in rock that is characterized by slips, joints, or other geologic anomalies that can result in weakened burden, it is essential that the certified blaster adjust the amount of explosive materials being loaded into boreholes. In addition, powder being loaded into front-line boreholes must be adjusted for any deviation in burden along the free-face to be blasted. Flyrock from the upper portion of loaded holes can be prevented by ensuring a sufficient amount of suitable stemming material to contain the energy of the blast within the confines of the borehole. A complete log of the condition of all boreholes drilled is an invaluable tool to assist the blaster in ensuring that all loaded holes have sufficient burden, and stemming to contain the explosive energy.

Secondary blasting of boulders should be avoided if possible. If it must be done, the following procedures are recommended:

- (1) Placement of the boulder in a lower level of the pit that affords increased confinement of thrown material during detonation.
- (2) Use of a single, small diameter borehole centered in the boulder. Orient boreholes away from persons or property.



**Ground Vibration** must be adequately controlled and within Mineral Mining Program prescribes limits. Mineral Mining Program regulation 4VAC25-49-880 allows mine operators to use one of three methods of compliance:

- (1) Designing blasts in accordance with the scaled distance formula.
- (2) Seismic monitoring of each blast to ensure peak particle velocity does not exceed the prescribed limit.
- (3) Seismic monitoring of each blast to ensure that blast vibrations do not exceed the limits based upon the vibration frequency.

Although it is unusual to find a violation of the Mineral Mining Program prescribed limits for ground vibration, low frequency blasting vibrations may result in citizen complaints. Precise timing of blast detonation utilizing electronic detonators, and reducing the maximum charge weight per delay period, can influence the vibration and frequency of ground motion resulting from blasting.

Controlling **Air Overpressure** presents a challenge because it is influenced by factors

beyond the blaster's control such as atmospheric conditions and local topography. Mineral Mining Program regulation 4VAC25-40-890 specifies a limit of 133 decibels (dB's) for air overpressure, however, blasting complaints are commonly registered when air overpressure exceeds 115dB's. Since most citizens blasting complaints are attributed to air overpressure, and its effect on structures, blasters must employ effective control measures. Some measures that should be employed include the following:

- (1) Ensure adequate burden around all loaded holes; decrease powder in areas of reduced burden.
- (2) Ensure loaded holes have a sufficient length of stemming to contain the explosive energy released during detonation; increase length of stemming on upper bench shots, or holes loaded in geologically weak rock.
- (3) Avoid blasting during a temperature inversion when warmer air is above cooler air, which could increase the level of air overpressure.
- (4) Avoid blasting on days when there is significant wind from the blast site towards nearby inhabited structures to minimize both air overpressure and post-detonation dust.



In addition to implementing measures to minimize the effects of blasting, mine operators should also include procedures intended to alert and protect

persons at or near the mine. Such procedures should include the following:

- (1) Establish a neighborhood out-reach program to inform neighbors of your blasting program and the controls in place to minimize adverse impacts on their property.
- (2) Offer to conduct pre-blast surveys of nearby homes to establish baseline conditions.
- (3) Offer neighbors the opportunity to attend a blasting information session and observe a blast.
- (4) Prior to detonation, alert nearby neighbors by telephone so they will not be startled by the blast.
- (5) Make sure the blast area is cleared of persons.

As a mine operator or certified blaster, you are a part of the community where the mine is located. People in the community can and do feel the effects of your blasting operations. Notwithstanding your intervention, the public's perception of explosives and blasting is often based solely on the destructive force of explosives so often displayed for dramatic impact in the media.

To improve public relations with your neighbors and avoid blasting complaints, it's important that you increase their knowledge of your blasting program and the measures being taken to protect their safety and property.

*For more information on this topic, contact the Mineral Mining office at (434)-951-6310.*



## **MINIMIZING THE OFF-SITE EFFECTS OF BLASTING**

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